DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

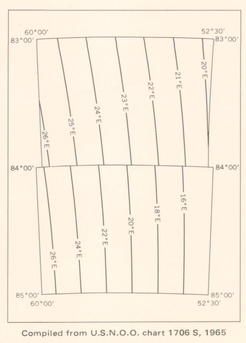
Prepared by the
U.S. GEOLOGICAL SURVEY
under the auspices of the
NATIONAL SCIENCE FOUNDATION

Base from U.S. Geological Survey
Gambacorta Peak, 1968, and Schmidt Hills, 1969

SCALE 1:250,000

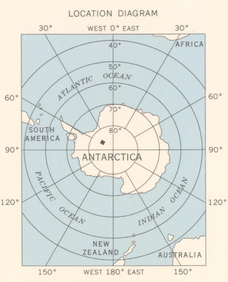
Geology mapped in 1963–64 by D. L. Schmidt, P.L. Williams, W. H. Nelson, and J.R. Eger, and in 1965–66 by D.L. Schmidt and W.H. Nelson

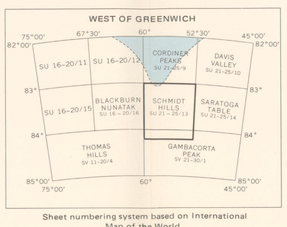
Polar Stereographic Projection—Standard Parallel 80°14'
CONTOUR INTERVAL 200 METERS—DATUM IS MEAN SEA LEVEL



Compiled from U.S.N.O.O. chart 1706 S, 1965

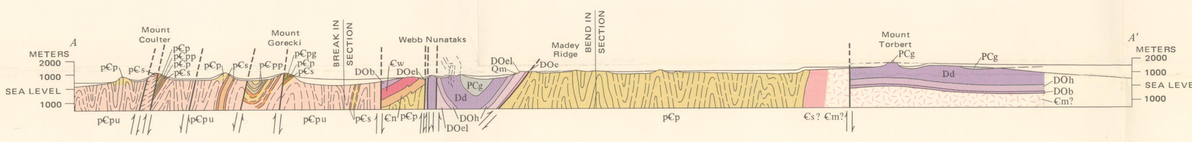
ISOGONIC LINE DIAGRAM



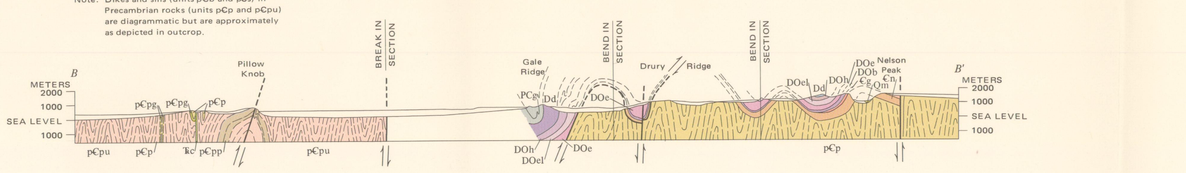


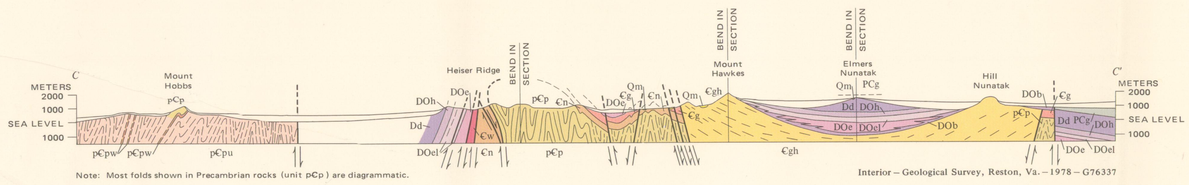
Sheet numbering system based on International Map of the World

INDEX TO ADJOINING SHEETS



Note: Dikes and sills (units pЄb and pЄs) in Precambrian rocks (units pЄp and pЄpu) are diagrammatic but are approximately as depicted in outcrop.

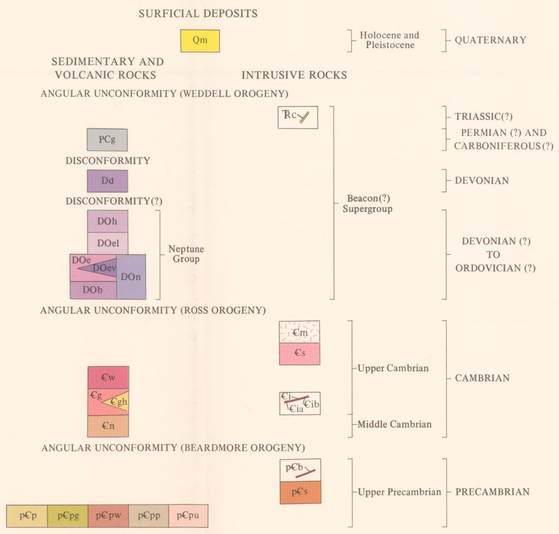




Note: Most folds shown in Precambrian rocks (unit pЄp) are diagrammatic.

Interior—Geological Survey, Reston, Va.—1978—G76337

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qm MORAINAL DEPOSITS (Holocene and Pleistocene) – Medium- to dark-gray non-weathered nonsorted debris comprising ablation moraine. Nearly all rock types in moraine occur in nearby and upslope outcrops; erratics are rare. A thin pebbly to bouldery pavement several centimeters thick at the surface consists of loose stones covering permanently frozen drift of fine and coarse debris. Calcium sulfate efflorescences form crusts on the underside of some surface cobbles. Moraines are associated with an ice level and ice configuration nearly identical to that of the present day. Scattered erratics of older moraine (not mapped) are found on most rock slopes and peaks and indicate an older, higher (Tertiary?) level that was more than 1,000 m above the present-day level

SEDIMENTARY AND VOLCANIC ROCKS

BEACON(?) SUPERGROUP (Triassic? to Ordovician?) – Includes clastic dikes (unit Ŧc), the Gale Mudstone, Dover Sandstone, and the Neptune Group

PЄg GALE MUDSTONE (Permian? and Carboniferous?) – Massive dark-gray diamictite (tillite) containing abundant dispersed pebbles, cobbles, and boulders of igneous and sedimentary rocks. A few thin layers of tan silty sandstone and conglomerate separate thick layers of tillite. The top of the underlying Dover Sandstone is grooved, and the tops of several boulder pavements within the Gale are well striated in a consistent southerly direction that suggests ice movement to the south. Probably several times as thick as a measured 315 m. Top not exposed

Dd DOVER SANDSTONE (Devonian) – White thick even-bedded medium-grained quartz sandstone containing conspicuous but widely scattered floating quartz pebbles; weathers tan. Many beds are orthoquartzite; some beds are coarsely crossbedded. Conglomerate, 0.3–7 m thick, of rounded quartz pebbles at the base contains sparse to locally abundant black pebbles of sedimentary phosphate. No fossils found in map area, but in the Patuxent Range 150 km southwest of the map area, the Dover contains several thin sandy carbonaceous lenses with a Middle Devonian microflora and a poorly preserved Devonian macroflora of *Haplostigma*(?) and "*Cyclostigma*-type" (Schopf, 1968; Rigby and Schopf, 1969). About 1,200 m thick

NEPTUNE GROUP (Devonian? to Ordovician?) – Includes the Heiser Sandstone, Elbow Formation, Elliott Sandstone, Brown Ridge Conglomerate, and Neith Conglomerate

DOh HEISER SANDSTONE – Well-bedded light-green quartz sandstone that is slightly more silty than the Dover; weathers brown. In places, rhythmically bedded pairs of silty sandstone and quartzite beds, 0.3–1 m thick, are common. Formation is characterized by many beds containing tubular burrows, ¼–1 cm in diameter, oriented vertically to bedding. About 320 m thick

DOel ELBOW FORMATION – Interbedded red argillaceous siltstone and light-gray fine-grained quartz-rich sandstone in well-bedded alternating layered pairs, 0.3–2 m thick, that reflect cyclical deposition; beds are well laminated, crossbedding common, and ripple marks sparse. The red beds are commonly mottled light gray. About 300 m thick

DOe ELLIOTT SANDSTONE – Thick-bedded, commonly crossbedded, pink to buff coarse-grained quartz-rich sandstone that is cemented by calcite in many places, especially in lower half. Contains some thin interbeds of buff conglomerate, conglomeratic sandstone, and red siltstone and shale. A basal conglomerate, locally as thick as 3 m, contains abundant volcanic pebbles. Volcanic-derived quartz and volcanic clasts predominate in lower part of formation but decrease in amount gradationally upward. Thickness ranges from about 1,400 m near the Gambacorta eruptive center near Gambacorta Peak to zero in the northern Neptune Range

DOev Rhyolite breccia member – Dark-reddish-brown to buff pyroclastic autolithic flow breccia of porphyritic rhyolite; consists of moderately welded, closely packed, subangular lithic fragments commonly 2–8 cm across. Occurs about 30 m above the base of the formation near Wiens Peak where it is about 70 m thick. May be genetically related to the Gambacorta Formation (€g) and Median Granite (€m). Rb-Sr whole-rock data from one sample suggest an age similar to that of the Gambacorta Formation (Eastin, 1970, p. 87–93, 112)

DOb BROWN RIDGE CONGLOMERATE – Poorly bedded to massive, poorly sorted, coarse, dark-reddish-brown conglomerate containing a few thin red sandstone beds and lenses. Locally in the lower part the conglomerate is green. Clasts consist of locally derived older sedimentary and volcanic rocks that are as much as 1 m in diameter; clasts of plutonic igneous rocks are absent. Conspicuous angular white quartz clasts derived from abundant veinlets in the Patuxent Formation are characteristic. Near the eruptive center of the Gambacorta Formation in the southern Neptune Range, the conglomerate consists chiefly of volcanic detritus; toward the north and west, away from the volcanic center, the volcanic content gradationally diminishes to nearly zero. Thickness ranges from zero to more than 800 m

DOn NEITH CONGLOMERATE – Poorly bedded to massive, poorly sorted, coarse, reddish-brown conglomerate interbedded with moderately well bedded coarse-grained reddish-brown sandstone. Clasts are derived chiefly from underlying sedimentary formations; clasts of plutonic rocks are minor or absent; Gambacorta volcanic clasts are absent; angular white quartz clasts from veinlets in the Patuxent Formation are conspicuous at the base. Basal part locally is dominantly conglomeratic and in places exceedingly thick; the upper part is dominantly sandstone. These rocks, which crop out on Neith Nunatak and are equivalent to the Elliott Sandstone and the Brown Ridge Conglomerate, are here named the Neith Conglomerate. Exact thickness is not established but locally may be as much as 1,000 m

€w WIENS FORMATION (Upper Cambrian) – Interbedded dark-green and dark-reddish-brown thin-bedded shale, siltstone, and fine-grained sandstone containing several beds, 3–10 m thick, of light-gray oolitic limestone. Lower part is interfingered with volcanic sediments of the upper part of the Gambacorta Formation. Nondiagnostic trace fossils occur sparsely on bedding planes. Thickness is less than 300 m in the southern Neptune Range but considerably more in the northern Neptune Range

€g GAMBACORTA FORMATION (Upper Cambrian) – Interbedded dark-brown, reddish-brown, and light-green rhyolitic to dacitic volcanic rocks that include ash flows, volcanic breccias, pyroclastic flows, lava flows, and agglomerates. Light-green ash-fall deposits and sandstones of reworked volcanic debris are abundant near top and bottom of formation. The Gambacorta Formation constitutes a volcanic complex that erupted from a center in the southern Neptune Range near Gambacorta Peak, where the formation is probably thicker than 1,500 m; the formation thins away from this center; it is about 160 m thick 40 km to the north. The Gambacorta Formation is divided into six members, of which only the Hawkes Rhyodacite Member can be shown at the map scale. Rb-Sr whole-rock data from 10 samples of the Gambacorta Formation, including the Hawkes Rhyodacite Member, suggest an isochron age of 510±35 m.y. (Eastin, 1970, p. 87–93, 112)

€gh Hawkes Rhyodacite Member – Dark-green porphyritic rhyodacitic welded tuff containing 30 percent coarse broken quartz, potassium feldspar, and plagioclase phenocrysts, as well as abundant inclusions of compacted pumice. Fine-grained groundmass is recrystallized but commonly shows a relic eutaxitic shard structure. Rock is locally oxidized to reddish-brown color. The member, as an intracaldera phase more than 1,000 m thick, is exposed at Mount Hawkes and Hill Nunatak and probably fills the Iroquois plateau beneath the Beacon strata in the intervening area. The caldera, here named for the Iroquois Plateau, is defined by a 10-milligal gravity low (Behrendt and others, 1974, pl. 1) and by a set of concentric border faults exposed near Mount Hawkes. A thin outflow phase of the Hawkes Rhyodacite Member, an ash-flow tuff, occurrs outside the caldera area.

€n NELSON LIMESTONE (Middle Cambrian) – Dark-gray thick-bedded massive limestone, commonly bleached light gray, constitutes the principal middle part of the formation. Above and below are thin-bedded light-gray algal(?) limestone and argillaceous limestone as well as thin irregular beds of yellow limy siltstone; some limestone is oolitic, pisolitic, or nodular. A basal dark-reddish-brown conglomerate, several centimeters to 30 m thick, is locally overlain by red-brown sandstone as much as 20 m thick; the clasts are derived from the Patuxent Formation and characteristically contain conspicuous pebbles of white vein quartz. Thickness is 200–300 m. A Middle Cambrian age is indicated by trilobites found about 4 km south of Nelson Peak (Palmer and Gatehouse, 1972)

pЄp PATUXENT FORMATION (upper Precambrian) – Well-bedded, generally rhythmically interbedded, medium- to dark-grayish-green medium-grained argillaceous metasandstone (metasubgraywacke) and slate; a few gritstone and intraformational sand-pebble and shale-pebble conglomerates form discontinuous beds and lenses. Channel fillings, graded bedding, crossbedding, laminated bedding, and sole markings are locally well preserved. This entirely clastic section of Patuxent Formation is mapped in the Neptune Range east of the fault of Roderick Valley. To the west in the Schmidt and Williams Hills three volcanic members, the Gorecki, Williams, and Pillow Knob Members, are intercalated with clastic rocks similar to those of the Patuxent Formation east of the fault of Roderick Valley. The stratigraphic positions of the three members within the Patuxent Formation are not understood because of intensive folding and faulting prior to extensive erosion beneath the Cambrian angular unconformity and because the base of the Patuxent Formation has not been observed. The age of the formation is probably late Precambrian based on an isotopic date of the Gorecki Felsite Member in the Schmidt and Williams Hills (Eastin, 1970, p. 100–103). The entire formation is regionally metamorphosed to the greenschist facies and is moderately well to well cleaved. Deformation and absence of distinctive marker beds of regional extent within the formation preclude accurate determination of thickness, but a minimum exposed structural relief of about 1,000 m in the Patuxent Range and widespread distribution throughout the Pensacola Mountains suggest a thickness of more than 10,000 m

pЄpg Gorecki Felsite Member – Light- to medium-gray porphyritic felsic tuffs and flow breccias, 2–100 m thick, are sparsely intercalated with sandstone and slate in the Schmidt and Williams Hills. Some tuffs exhibit well-developed eutaxitic shard structure suggesting an ash-flow origin. Chemical composition of the rocks ranges from dacite to rhyolite. The Gorecki Felsite Member is here named for Mount Gorecki, where its type section is located. Rb-Sr whole-rock data from four samples suggest an isochron age of 1,210±76 m.y., but four other samples give a reset date of 488±6 m.y. (Eastin, 1970, p. 101–103). The aggregate thickness of exposed felsite is probably less than several hundred meters. Flows are shown schematically on map

pЄpw Williams Basalt Member – Dark-gray to dark-green basalt flows intercalated with sandstone and slate in the Williams Hills. Flows are 2–30 m thick and constitute about 15 percent of the exposed rock in the Williams Hills; aggregate thickness of basalt may be 1,000 m. In places flows may be erroneously mapped as diabase of Schmidt Hills (pЄs). Most flows are shown schematically on the map. The Williams Basalt Member is here named for the Williams Hills, where its type section is located

pЄpp Pillow Knob Basalt Member – Dark-gray to dark-green massive pillow basalt in the Schmidt and Williams Hills. Pillows range from 5 cm to 1 m across and are set in an argillaceous or locally calcareous matrix. Layering is poorly defined. The total thickness may be several hundred meters. The Pillow Knob Basalt Member is here named for Pillow Knob, where its type section is located

pЄpu Patuxent Formation and diabase of Schmidt Hills, undivided (upper Precambrian) – Unit is mapped in Schmidt and Williams Hills where outcrop was not field checked and in areas concealed by snow

INTRUSIVE ROCKS

Ŧc CLASTIC DIKES (Triassic?) – Light-buff to dark-gray, mostly medium-grained, quartz-rich sandstone dikes cutting rocks as young as the Dover Sandstone (Dd); some dikes may be older because some dike rock is well cleaved and cuts rocks as old as the Patuxent Formation(pЄp). Dikes range in width from 0.1 to 5 m. The direction of intrusion, where determined, is downward; on Mount Feldkotter, dike rock derived from tillite of the Gale Mudstone cuts the Dover and Heiser Sandstones at least 1,300 m stratigraphically below the Gale. The younger dikes were probably emplaced during the early Mesozoic orogeny

€m MEDIAN GRANITE (Upper Cambrian) – Light-gray and light-red coarse-grained biotite granite that is not exposed but is derived from the inferred Median pluton, which is estimated to underlie a large area beneath the Median Snowfield west of Serpan Peak. The Serpan Gneiss (€s) is the exposed border phase of the pluton. The location and size of the pluton can be estimated from a negative gravity anomaly of at least 30 mgal (Behrendt and others, 1974, p. 11) and by the distribution of granitic erratics in moraines down-glacier from the inferred pluton. Rb-Sr whole-rock data from three samples suggest an isochron age of 530±34 m.y. (Late Cambrian) (Eastin, 1970, p. 97; Schmidt and Ford, 1969)

€s SERPAN GNEISS (Upper Cambrian) – Dark- to light-gray banded gneiss of sphene-bearing hornblende-biotite granodioritic and biotite granitic composition. Rb-Sr whole-rock data from eight samples suggest an isochron age of 525±15 m.y. (Eastin, 1970, p. 97). The Serpan Gneiss is here named for Serpan Peak, which is its only known outcrop and where it is more than 700 m wide; it is believed to be a border phase of the Median Granite (€m)

€i DIKES, SILLS, AND PLUGS (Upper Cambrian) – Buff to drab-green porphyritic felsic intrusive rock; commonly with aphanitic groundmass and chilled margins. Dikes and sills commonly 1–5 m wide; plugs 5–40 m across. Most rocks are probably related to the Gambacorta Formation and Median Granite. A Rb-Sr whole-rock date of the plug on Baker Ridge indicates Cambrian age (Eastin, 1970, p. 92)

€ia Aplite dike (Upper Cambrian) – Light gray; 0.3 m wide; cuts Serpan Gneiss at Serpan Peak. Rock is probably related to the Median Granite

€ib Breccia dike (Upper Cambrian?) – Dark-reddish-brown to light-reddish-brown and dark-green, aphanitic to finely crystalline mafic intrusive breccia, highly contaminated by carbonate; intrudes Nelson Limestone. Age is uncertain

pЄb BASALTIC DIKES AND SILLS (upper Precambrian) – Dark-gray to dark-green basaltic rock in bodies 1–2 m wide; mapped in the western Neptune Range; has well-developed regional axial-plane cleavage and is intrusive into the Patuxent Formation. Age uncertain but probably Precambrian

pЄs DIABASE OF SCHMIDT HILLS (upper Precambrian) – Dark-gray olivine-bearing augite-labradorite alkali basalt, well differentiated in thick sills intrusive into Patuxent Formation in the western Neptune Range. Sills are 2–150 m thick and constitute about 30 percent of the exposed rock in the Schmidt Hills. Alteration to chlorite and more sodic plagioclase is extensive, and rock is commonly intensely folded and sheared with the rocks of the Patuxent Formation. Age is probably slightly younger than that of the Patuxent Formation; Rb-Sr whole-rock data on six samples suggest an estimated isochron age of 778±59 m.y.; however, a 2-point isochron suggests a possible maximum age of 1,267 m.y. (Eastin, 1970, p. 107). In places may be erroneously mapped as Williams Basalt Member of Patuxent Formation. Most of the sills are shown schematically on the map

Contact – Mostly exposed in areas of bedrock outcrop; inferred where covered by ice, snow, and moraine

Contact of Median Granite – Concealed; inferred location based on negative gravity anomaly (Behrendt and others, 1974, p. 11)

High-angle fault – Showing dip. Inferred where covered by ice, snow, and moraine. U, upthrown side; D, downthrown side. Half arrows indicate probably direction of horizontal movement

Bedding-plane fault – Sawteeth on upper plate. Shear on bedding planes is common, especially at Cambrian-Precambrian unconformity. Fault shown only where movement is inferred to be significant

Main ring-fracture of the Iroquois caldera – Inferred position based in part on a 10-mgal gravity low (Behrendt and others, 1974, pl. 1)

Major folds in Phanerozoic rocks – Showing crestline or troughline and plunge. Inferred where covered by ice and snow and in Precambrian rocks. Plunges verified from stereographic plots

Anticline – Showing plunge

Syncline – Showing plunge

Asymmetric anticline – Showing dip of limbs; short arrow indicates steeper limb

Overturned syncline – Showing direction of dip of limbs

Minor folds – Showing plunge

Anticline – Showing crestline

Syncline – Showing troughline

Multiple folds – Showing axial trend

Antiform – Inferred anticlinorial fold. Involves refolded, previously isoclinally folded Patuxent Formation in Schmidt Hills

Strike and dip of beds

Horizontal

Inclined

Vertical

Overturned

Flow foliation – Showing strike and dip in volcanic rocks

Strike and dip of principal cleavage

Inclined

Vertical

Strike and dip of secondary cleavage

Inclined

Vertical

Strike of vertical joint

Stereogram summation of fold and cleavage – Showing average axial trend and common range of plunge of abundant isoclinal folds and average strike and common range of dip of cleavage in Patuxent Formation in Schmidt and Williams Hills

Bedrock outcrop

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GEOLOGIC MAP OF THE SCHMIDT HILLS QUADRANGLE AND PART OF THE GAMBACORTA PEAK QUADRANGLE, PENSACOLA MOUNTAINS, ANTARCTICA

By
Dwight L. Schmidt, Paul L. Williams, and Willis H. Nelson

1978

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